

**WHAT IS CLAIMED IS:**

1 A variable geometry turbocharger comprising:

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AS  
5 a turbine housing having an inlet for exhaust gas and an outlet,  
a volute connected to the inlet and an integral outer nozzle wall adjacent the  
volute;

a center housing attached to the turbine housing and having a  
center bore carrying a bearing assembly;

10 a compressor housing having an air inlet and a compressed air  
outlet, the compressor housing attached to the center housing;

a turbine wheel carried within the turbine housing and attached  
to a shaft extending through the center housing, supported by the bearing  
assembly, the shaft attached distal the turbine wheel to a compressor impeller  
carried within the compressor housing;

15 a plurality of vanes having rotation posts extending from a first  
surface substantially parallel to the outer nozzle wall, the posts received in  
circumferentially spaced apertures in the outer nozzle wall, the vanes further  
having actuation tabs extending from a second surface of the vanes distal the  
first surface;

20 a unison ring intermediate the center housing and the vanes, the  
unison ring having a plurality of slots equal in number to the vanes, said slots  
oriented obliquely to a circumference of the unison ring and receiving the tabs,  
the unison ring further having a radial slot;

25 a crank shaft having a pin engaging the radial slot, the crank  
shaft movable continuously from a first position to a second position,  
movement of the crank shaft causing the pin to translate in the radial slot and  
impart force perpendicular to the radial slot to urge rotational motion of the  
unison ring, the rotational motion of the unison ring causing the tabs to

traverse the actuation slots from a first end of the slots to a second end of the slots; and

means for moving the crank shaft from the first position to the second position.

2. A variable geometry turbocharger as defined in claim 1 wherein the tabs incorporate substantially flat sides to be received within the actuation slots.

3. A variable geometry turbocharger as defined in claim 2 wherein the actuation slots incorporate a profile predetermined to provide maximum engagement of a first side of each tab with the tab located at the first end and second end of the slot and maximum engagement of a second side of each tab with the tab located in the slot intermediate the first and second end.

4. A variable geometry turbocharger as defined in claim 1 wherein the moving means comprises a hydraulic actuator integral with the center housing and having

a piston received in a boss integrally cast in the center housing for reciprocating motion perpendicular to the crank shaft;

a piston rod attached to the piston at a first end;

means for attaching the piston rod to the crank shaft, the attaching means converting reciprocating motion of the rod to rotational motion of the shaft; and

means for controllably varying hydraulic pressure on opposing sides of the piston to induce motion from a first position corresponding to the first position of the crank shaft to a second position corresponding to the second position of the crank shaft.

5. A variable geometry turbocharger as defined in claim 4 wherein the attaching means comprises:

a gear rack on the piston rod; and  
a pinion gear on the crank shaft.

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6. A variable geometry turbocharger as defined in claim 4 wherein the means for controllably varying the hydraulic pressure comprises:

a hydraulic valve stem having multiple ports and movable by an variable current electric solenoid balanced by a bias spring;

10 a hydraulic pressure source in communication with a first port with the stem in a first position and a second port with the stem in a second position;

a hydraulic drain in communication with a third port with the stem in the first position and a forth port with the stem in the second position;

15 a first conduit communicating with the a first side of the piston and communicating with the first port with the stem in the first position and the forth port with the stem in the second position;

a second conduit communicating with a second side of the piston and communicating the third port with the stem in the first position and the second port with the stem in the second position; and

20 a cam on the crank shaft operatively engaging the bias spring.

7. A variable geometry turbocharger as defined in claim 1 wherein the actuation slots are blind and further comprising:

25 an annular channel in the center housing closely receiving the unison ring; and

means for supplying air pressure to the channel to urge the unison ring into close contact with the second surface of the vanes.